# MERGING INFORMATION COMMUNICATION AND TRANSPORTATION IN KOREA

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***ABSTRACT***

*It is now becoming recognized that the traffic signals alone cannot solve congestion oriented transportation problems in principle while enhancements are added to the system. A new way recently being studied is providing drivers with real-time traffic information on trip time, congestion, accidents, restrictions and regulations, construction, parking lots and so forth. This makes drivers themselves select and use less busy routes with priority. Consequently, it reduces travel time, energy consumption, air pollution and increases safety, mobility, economic productivity, and efficiency of road networks. This combination of information, communication and transportation is called an intelligent transport system (ITS). Recently, the Korean government has initiated a comprehensive ITS development programme. This paper describes the programme briefly.*

## Introduction

Traffic congestion is considered as one of the most important transportation problems which has to be solved to upgrade the quality of life of citizens. It was analyzed that the gross economic loss in Korea due to the traffic congestion exceeded US $13 billion for the year of 1994 and it would be continuously increased by more than $2.5 billion every year. Considering the current statistical data of 45 million inhabitants and 7.5 million vehicles, this is equivalent to that of every person wasted $289 and every vehicle $1,733 in 1994 due to traffic congestion.

The conventional traffic control and management performance was largely based upon traffic signal control unit systems designed to maximize transport capacity of each road. With this local control method, it is difficult to expect to maximize the overall transport capacity of the whole area-wide road network.

For this purpose, road traffic management will gradually move into the direction of enhancing the total transport capacity of a network by guiding vehicles to use less busy roads. This new control concept of moving more vehicles into the less busy roads is a basic principle to improve the efficiency of a given road network and is based upon mobile communication systems providing real-time traffic information to drivers so that they can use less busy roads.

We recognize the 21st century as an age, of their information society. Advanced information technology is expected to play a more and more important role in every corner of society as time goes by. A coupling of computer and communication technologies has electronized all the process of information management and delivery. For example, fund transfer, commercial trading and transactions in the form of point-on-sale (POS) and electronic data interchange (EDI) technologies. In the last decade, advances of mobile communication systems technology have been the focus of many major technical developments through the world. The advent of the mobile system has had a remarkable influence on the ability of the individuals to keep in touch wherever they are.

We are now facing a new coupling of information and mobile communication technology, namely mobile information technology, which is aiming to electronize the road transportation system.

## ITS and information technology

ITS development with regard to traffic congestion can be largely categorized into following two parts:

- the first is dynamic navigation technologies which support drivers to reach their destinations in the shortest time avoiding congestion;
- the second is super smart vehicles making drivers enjoy easy, safe and even unmanned driving environment.

The super smart vehicle is mainly dependent on the cybern control and intervehicle communication technologies. However, the dynamic navigation is fully based on the mobile information technologies delivering the live traffic information in real time to drivers or in-vehicle processors. Hence, it can be said that the better information can improve the quality of transportation systems.

The conventional system, composed of traffic control and monitoring functions dark shadowed blocks in the center of the figure, works in the way of reducing the only waiting queue at the intersection and it does not have any other abilities to prevent the blind vehicles rushing into the congested roads. The light shadowed blocks of traffic information and travel information are concerning the ITS function. It has more dynamic control span compared to the conventional system and has a smart ability to draw the traffic flow to less busy roads at both on-trip and pretrip stages. The white blocks in the upper part are relevant to super smart vehicles. The vehicle control acts as a cybern driver such that it allows vehicle itself to have the same driver behaviour. And, the cooperative driving can self-organize platoon and train-like driving groups by means of inter-vehicle communication directly between vehicles or with ITS.

Imagine how road transportation will change if vehicles have abilities to see the traffic situation at 500 meters ahead? Maybe, no vehicles will enter the congested roads because they already have the information. Just delivering the information to running vehicles brings such a tremendous change to transportation systems that every drivers autonomously rush into less busy roads and consequently every roads go load balanced to help improve road network efficiency. This is the very essence of ITS we aim.

Here, we can see the paradigm shift moving to the driver control beyond the signal control. ITS is not a distant vision. Some first-generation system are, in fact, on the market. Over the next 20 years, Korean ITS is expected to create a $20 billion industry and reduce an economic loss of $26 billion due to traffic congestion. The other effects are difficult to predict the outset of the programme. Still, it is clear that ITS can yield substantial benefits widely distributed among our society.

**ITS initiative and R&D organization**

Computerized traffic signal systems have been operated in major cities in Korea since 1980, however the systems have something inefficient in dealing with pseudo-saturated traffic in urban areas. A new traffic signal system with advanced on-line and real-time traffic-adaptive control function and automatic signal timings being adjusted in response to the cyclical variation of traffic load has been installed since 1993.

This system exhibits an outstanding ability to cope with even pseudo-saturated traffic but is still insufficient to control the blind vehicle streams pushing into the congested area. There have been issued the necessity of ITS introduction from academia, research institutes, industries and some government agencies since April 1993. The Social Overhead Capital (SOC) investment mission under the Office of President started to consider the introduction of ITS and made a draft for the ITS development plan in October 1993 and it was financed at the end of 1993. Now, the SOC became a new organization called the Presidential Commission on Competitiveness (PCC). The implementation of ITS requires multi- disciplinary and multi-sector cooperation among all levels of governments, private sectors, research institutes and academics. ITS embodies a wide array of technologies, but the challenges are not solely technical. Organizational, institutional and legal issues must be resolved before developments can take place. Therefore, a master plan for ITS architecture and applications would be better established at a government level. In this regard, the SOC together with concerned government agencies derived some guidelines in February 1994. Those are summarized as follows:

- ITS shall be driven pan-governmentally as a national programme.
- The central government agencies play a major role in ITS planning and its implementation will be made under close cooperation with local governments.
- All government agencies will collaborate on establishing ITS architecture and a master plan.

Thus, a major national initiative is underway to apply proven information, communication and control technologies to road transportation to improve its efficiency and reduce its negative impacts. ITS will be applied to all types of vehicles (trucks, buses and cars), to information devices(computer, kiosks and hand-held devices),and to all parts of the road transportation system(highways, urban arterial, rural roads, and intermodal connections). Deploying

ITS can improve safety, reduce congestion and improve mobility, reduce environmental pollution and increase energy efficiency, improve economic productivity, and create a new ITS industry.

The Presidential Commission on Competitiveness (PCC) and Intelligent Transportation Society of Korea (ITS-Korea) are working with many organizations at the national level to make ITS a reality.

ITS development programme continues until 2005 and a master plan which contains a national architecture will be in place by late 1995 or early 1996. Afterwards, ITS applications (see section 4) and necessary tasks will be divided into each pertinent government agency according to their own mission as follows:

- MCT: Public transportation, Commercial vehicle operations, Electronic payment and Automated highway system

- NPA: Traffic control and management system

- NEC: Traveller information service and Communications system

- MTI: Advanced vehicle control and Dynamic navigation system.

**ITS goals and applications**

The road transportation situation in Korea is much more difficult than those of advanced countries due to poor infrastructure. Many of the nation's roads and most urban roads are badly clogged. Congestion continues to increase even though the government has been working hard to build more roads as much as possible. Overall mobility is highly threatened, especially in urban areas. Average vehicle speed in urban areas is now dropped to 24km/h from 38km/h in 1991 and it is expected to drop to 18 kmh in 2001. The speed is reduced to two thirds every five years. Safety continues to be a prime concern. In 1994, 10,402 people died in traffic accidents and around 340 thousand were injured. A campaign to reduce the traffic accidents to half this rate has been started from this year. Public transportation systems due to shortage of utilities and poor services are seen as an unattractive alternative to driving. Low rate of subway usage in passenger traffic also helps to worse the road transportation. In case of Seoul, subways share only 25% of passengers but buses 40%, taxies 10% and private vehicles 25%. This is in contrast to Tokyo subways which carry 75%. Economic loss due to congestion cost $13 billion as mentioned earlier and traffic accidents drained away $7 billion more in 1994. There are also other costs including needless waste of energy, emission of pollutants and loss of productivity. The number of vehicles in Korea exceeds 7.5 million in 1994 and it will reach 15 million in 2001 and 25 + million in 2010.

This means vehicles increase at annual growth rate of 12%. However, the road space will expand by 2-3% for five years from 20% in 1994 to 23% in 2001. Hence, goals of ITS development is established to solve these problems and lifting a bright vision to the future. Subsequently, the identification of ITS applications and service definitions to meet the goals was prepared. Currently, there are four application areas. Application areas and definitions may change over time as more information is gained through the progress of the programme.

**Traffic control and management**

Application provides limited information services to help drivers avoid delays using en-route driver information and/or centrally determined route guidance (CDRG) system in urban areas. This category of services provides improved surveillance and traffic control procedures and mechanisms to transportation system efficiency. Enforcement, emergency and travel demand management are also included here.

**Traveller information service**

Application, usually via independent service provider (ISP) or common service provider (CSP), provides the full-range information services from pre-trip travel information to real-time traffic information. The latter information is central to vehicles equipped with dynamic navigation system (DNS) or locally determined route guidance (LDRG) systems. Here, the information covers trip-time, congestion, accidents, construction, restriction, road condition, parking lots.

**Public transportation and commercial vehicle operations**

Application makes public transportation more attractive to potential passengers and electronizes administrative procedures (vehicle electronic clearance, automated roadside inspection, on-board safety monitoring and vehicle administrative processes) to help of efficiently manage commercial fleets.

**Advanced vehicles control system**

Application offers various forms of collision avoidance and safety precautions. Automated vehicles with the functions of unmanned driving and cooperative driving will remain a longer-term objective. This category also covers electronic payments and automated highway system services.

## CONCLUSION

Traffic congestion represents one of the most worrying problems with social impacts and heavy penalties for the whole community in terms of direct and indirect costs. Information applied to vehicles can provide efficient tools for the design and the operation of transportation system solutions.

An integrated information, communication and transportation management approach has been presented, in which more positive and active attitude to utilize driver's intelligence should be recommended. This is the key point of discussion. Congestion and efficiency of road networks can hardly be solved by the passive approach like merely expanding roads and traffic signals. Even advanced countries can not expand road networks as fast as the number of vehicles increases. That is why the most developed nations are so concentrating their energies on ITS development.

Information and communication are considered as important technologies in ITS. Most developments of mobile information technologies in Europe are classified as a kernel project while a lot of ITS projects are in progress, the development of ITS architecture of America is now being refined based on communications infrastructure, and a similar ITS architecture of Japan called Grand Design will be expected at the end of 1995. Now, it may be said that ITS is not an issue of a single nation but a global issue. As the World Trade Organization (WTO) was established, ITS also should make free trade possible and ITS services could be accessed extensively beyond borders. Accordingly, the International Telecommunications Union (ITS set the target for the international standards of ITS communications by 1997 and the International Standards Organization (ISO) has already been underway standardization of ITS technologies since 1993. In addition, the ITS world congress has inaugurated worldwide cooperation and collaboration to develop and implement ITS technologies and the first meeting was held in Paris in November 1994. This paper described ITS technologies and its development progress in Korea. ITS is still in an infant stage but, it will soon become an exiting technology in transportation helping to solve social and ecological problems.

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